[0011] FIG. **1** is a side view of a surge protector for use in a radio frequency environment according to an embodiment of the present invention;

[0012] FIG. **2** is a cross-sectional view of the surge protector of FIG. **1** illustrating various internal components of the surge protector according to an embodiment of the present invention;

[0013] FIG. **3** is a perspective view of the surge protector of FIG. **1** illustrating the various internal components shown in FIG. **2** according to an embodiment of the present invention; and

[0014] FIG. **4** is a network analyzer plot illustrating a frequency response of the surge protector of FIG. **1** according to an embodiment of the present invention.

DETAILED DESCRIPTION

[0015] Referring to FIGS. **1**, **2**, and **3**, a surge protector **100** is shown. The surge protector **100** may be inserted between a pair of coaxial cables or devices. For example, the surge protector **100** may be used in radio frequency communications to protect radio frequency components from power surges such as those resulting from lightning strikes.

[0016] The surge protector **100** has a longitudinal axis A-A along with a first axial end **102** and a second axial end **104**. The first axial end **102** includes external, or male, threading and the second axial end **104** includes internal, or female, threading. In some embodiments, either or both of the first axial end **102** or the second axial end **104** may include male or female threading depending on the application in which the surge protector **100** will be used. In some embodiments, either or both of the first axial end **102** or the second axial end **104** may include any other connection type.

[0017] The surge protector **100** also includes a housing **106** having a first housing portion **108** and a second housing portion **110**. The housing **106** defines a cavity **107**. The surge protector **100** also includes a pair of center conductors including a first center conductor **112** and a second center conductor **114**. The center conductors **112**, **114** may be positioned at the axial ends **102**, **104** of the surge protector **100**. One of the center conductors **112**, **114** may receive an input signal and the other of the center conductors **112**, **114** may output the signal after any surge element has been removed from the signal. Due to the relatively symmetrical design of the surge protector **100**, either of the first center conductor **112** or the second center conductor **114** may correspond to the input and the other of the first center conductor **112** or the second center conductor **114** may correspond to the output.

[0018] The surge protector **100** may also include an inner coupler **116** and an outer coupler **118**. The inner coupler **116** may be electrically coupled to the first center conductor **112** via a first extender **164**, and the outer coupler **118** may be electrically coupled to the second center conductor **114** via a second extender **166**.

[0019] The inner coupler **116** may include a first axial end **120** positioned nearest the first center conductor **112** and a second axial end **122** positioned nearest the second center conductor **114**. The inner coupler **116** may also include a center portion **124**, which may resemble a shaft, and a base portion **126**. The base portion **126** may define an annular volume **128**. The inner coupler **116** may also include an outer surface **130**.

[0020] The outer coupler **118** may include a first axial end **132** positioned nearest the first center conductor **112** and a second axial end **134** positioned nearest the second center conductor **114**. The outer coupler **118** includes or defines a hollow cylinder **136** having an inner surface **138**. The inner surface **138** defines a volume **142**. The outer coupler **118** also includes an outer surface **140**.

[0021] The inner coupler **116** is designed to interface with the outer coupler **118**. In particular, the second axial end **122** of the inner coupler **116** interfaces with the first axial end **132** of the outer coupler **118**. The center portion **124** of the inner coupler **116** is designed to be received by the volume **142** of the outer coupler **118**. Furthermore, the first axial end **132** of the outer coupler **118** is designed to be received by the annular volume **128** defined by the base portion **126** of the inner coupler **116**. The inner coupler **116** may also be referred to as a "piston" and the outer coupler **118** may also be referred to as a "cylinder."

[0022] A first dielectric material **144** is positioned in the volume **142** radially between the center portion **124** of the inner coupler **116** and the inner surface **138** of the outer coupler **118**. Likewise, a second dielectric material **146** is positioned in the annular volume **128** radially between the outer surface **140** of the outer coupler **118** and the base portion **126** of the inner coupler **116**. The first dielectric material **144** and the second dielectric material **146** may include a non-conductive dielectric such as Teflon.

[0023] The inner coupler **116** and the outer coupler **118** may each be made of a conductive material. The inner coupler **116** and the outer coupler **118** are not in direct contact. Any signal that propagates between the inner coupler **116** and the outer coupler **118** must propagate through the first dielectric material **144** and the second dielectric material **146**. Thus, the interface between the inner coupler **116** and the outer coupler **118** may function in a similar manner as a capacitor. In that regard, a signal having a sufficiently low frequency may not propagate between the inner coupler **116** and the outer coupler **118**.

[0024] The surge protector **100** also includes a first spiral inductor **190** and a second spiral inductor **192**. Each of the first spiral inductor **190** and the second spiral inductor **192** has an inner curve **150** and an outer curve **148**. The inner curve **150** of the second spiral inductor **192** is coupled to the outer coupler **118** and, thus, the second center conductor **114**. The inner curve of the first spiral inductor **190** is coupled to the inner coupler **116** and, thus, the first center conductor **112**. The outer curve **148** of each of the first spiral inductor **190** and the second spiral inductor **192** is coupled to the housing **106**.

[0025] When a signal having a sufficiently low frequency is received by the inner curve **150** of either of the first spiral inductor **190** or the second spiral inductor **192**, the low-frequency signal travels through the corresponding inductor to the housing **106** which is connected to a ground. In that regard, the low frequency signal will not propagate through the surge protector **100**.

[0026] The surge protector **100** also includes a tube **152**. The tube **152** may include a metal, such as copper, and thus be conductive. The tube **152** is positioned within the housing **106** axially between the first spiral inductor **190** and the second spiral inductor **192**. In that regard, the tube **152** resists movement of the first spiral inductor **190** towards the second spiral inductor **192** and vice versa.

[0027] The cavity **107** defined by the housing **106** has a cavity diameter **154** in a location axially aligned with the center conductors **112**, **114**. The center conductors **112**, **114**